DEVICE, METHOD, AND SYSTEM FOR REMOVING CONTAMINANTS FROM A LIQUID

This application claims priority from U.S. Provisional Patent Application Serial No. 60/177,188, filed on January 15, 2000.

FIELD OF THE INVENTION

The present invention relates to a device capable of removing contaminants in a liquid and a method and system for such a device. More particularly, this invention relates to a device used in a brewed beverage maker for removing contaminants in a liquid and a method and system such a device.

BACKGROUND OF THE INVENTION

Devices of various configurations for removing contaminants from liquids are employed daily in households. The term removing as used herein encompasses actions against a contaminant, such as separating, absorbing, adsorbing, capturing, binding, altering, transforming, rendering inert, and destroying.

In most households, coffee, tea, and other brewed beverages are typically made in automatic drip-type beverage makers. Such beverage makers typically have a reservoir of liquid, such as water, and heat the liquid with a thermo-siphon heater. The heated liquid is delivered to a brewing basket that contains the brewing

ingredients, wherein the heated liquid steeps in the brewing ingredients. The resulting brewed beverage passes through the brewing basket into a beverage collector, or carafe, positioned below. The beverage collector is typically kept warm by a heating element.

Water and other liquids used in these drip-type beverage makers can contain contaminants. These contaminants include particulates, chemicals, and germs (i.e., viruses, bacteria, mold, pollen, oocysts, and protozoa). Common liquid-borne particulate contaminants are dirt, rust, silt, and heavy metals. Lead, a heavy metal, is particularly common because it is found in water fixtures, pipes, and pipe solder. Chemical contaminants may consist of chlorinated hydrocarbons, free chlorine, pesticides, petroleum-based chemicals, and synthetic organic chemicals. Germs that commonly contaminate water include protozoan cysts, such as *Cryptosporidium Parvum* and *Giardia*, and bacteria, such as *E. coli* and *Cholera*. Thus, not only will contaminants noticeably and adversely affect the aroma, taste, and other qualities of the brewed beverage, contaminants are also potentially dangerous to the brewed beverage drinker.

The typical brewing basket found in most beverage makers is roughly shaped as an inverted cone, conoid, or pyramid. The brewing basket supports a fluted or pleated bowl-shaped paper filter that generally conforms to the shape of the brewing basket. The principal function of the paper filter is to support the brewing ingredients and prevent them from passing into the underlying beverage collector. Thus, the paper filter that is held in the brewing basket generally does not remove liquid-borne contaminants.

A contaminant remover must be employed to remove or otherwise render inert contaminants in the liquid, ideally, before the liquid contacts the brewing ingredients. Yet, typical beverage makers cannot fit a contaminant remover between the liquid reservoir and the brewing ingredients. Reasons for this include the fact that beverage makers for home use must be compact. Also, retrofitting a contaminant remover is often not possible.

U.S. Patent Nos. 5,318,703, 5,393,548, and 5,505,120 provide similar methods and devices for retrofitting a contaminant remover into a coffee maker. First, U.S. Patent No. 5,318,703 provides a water filter module that includes a plurality of support feet. In operation, the water filter module is placed with its support feet on top of a mound of ground coffee. Second, U.S. Patent No. 5,393,548 provides a method wherein a water filtration device is positioned between the hot water drip outlet and the ground coffee beans. In use, the water filtration device is inserted into the brewing basket such that the device rests on the ground coffee beans. Third, U.S. Patent No. 5,505,120 provides an apparatus for brewing coffee having a basket for accommodating coffee grounds and a filter means located in the basket. The filter means is placed on top of the coffee grounds.

These designs suffer from several drawbacks. First, the filter device, or contaminant remover is positioned in very close proximity to the coffee grounds. Accordingly, the contaminant remover can become tainted with wet coffee grounds, thus, requiring that the contaminant remover be cleaned after each use, which is clearly inconvenient. Furthermore, the filter device is not in contact with the

sidewalls of the brew basket, which results in the filter device being stabilized only by the loose brewing ingredients upon which it is placed.

The prior art illustrates that, although many different devices presently exist that remove contaminants in liquid used to brew beverages, there is still a need for a device that can be used in existing beverage makers to remove liquid-borne contaminants, is convenient to use, clean, and replace, and has a low resistance to flow. Ideally, such a contaminant remover will not come in contact with the brewing ingredients.

SUMMARY OF THE INVENTION

There is provided a beverage maker having a device that removes contaminants from a liquid, which is removably supported within a compartment for ingredients. The device is preferably a filter that is surrounded by a supporting member, which supports the device within the compartment. The supporting member around the device may have a plurality of outwardly-protruding extensions that support the device by fitting against the sidewall of the compartment. A method and a system for such a device are also provided.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a device according to the present invention;

FIG. 2 a top view of the device of Fig. 1;

FIG. 3 is a cross-sectional view of the device of Fig. 1 along line a--a;

FIG. 4 is a cross-sectional view of a brewing basket having the filter of Fig. 1 positioned therein;

FIG. 5 is a cross-sectional view of a preferred embodiment of the filter media for the filter of Fig. 1; and

FIG. 6 is a cross-sectional view of an alternate preferred embodiment of the filter media for the filter of Fig. 1.

FIGS. 7 through 11 is a device according to the present invention having filter medium supports adapted for use as an integrated handle.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 illustrates a contaminant removing device embodying the present invention, referred to generally as **10**, which is adapted to remove contaminants from a liquid used to brew beverages. Device **10** preferably has a filter medium **20** and a surrounding wall or frame **12**. Device **10** is ideally intended for use in brew basket **50** (see Fig. 4) of a typical brewed beverage maker and the area and height of device **10** are preferably dimensioned so that device **10** will fit completely therein, yet remain separated from any brewing ingredients **55** contained in brew basket **50**.

Wall or frame **12** surrounds filter medium **20** and is adapted to support filter medium **20** during the use of device **10**. Wall **12** may be formed of any suitable material and, preferably, is formed of a thermoplastic material, such as polyethylene.

A reserve capacity is preferably created by extending wall **12** above filter medium **20** since liquid may enter device **10** more quickly than it can pass therethrough. The reserve capacity is defined by a distance ***d*** (see Fig. 3), which is between a top rim **14** of wall **12** and filter medium **20,** multiplied by the area of filter medium **20**. The area of filter medium **20** should be made as large as reasonably possible, while distance ***d*** should be configured to provide enough reserve capacity to prevent the overflow of liquid. The preferred distance ***d*** will depend on the flow rate of liquid through filter medium **20** and the size of brew basket **50.**

Although wall **12** is preferably an annular sidewall surrounding a circular-shaped filter medium **20**, wall **12** may take any form dictated by the application

environment. A circular shape is useful for a brew basket that is generally shaped as an inverted cone or conoid. Also, wall **12** may be provided with features that are appropriate for the application environment, such as an inwardly projecting semicircular indentation **15** or a tapered bottom rim **13** (not shown).

Wall **12** may be releasably or permanently attached to filter medium **20** using any technique know to the art. For example, in a preferred embodiment of device **10**, filter medium **20** is heat sealed to wall **12**. Wall **12** may alternatively be insert molded around filter medium **20**. A further alternative would be adapting wall **12** to releasably receive filter medium **20** so that filter medium **20** could be replaced when necessary. If filter medium **20** was releasably attached to wall **12**, it would be preferable that filter medium **20** have a rigid or semi-rigid rim disposed thereabout, which is adapted to be snap-fit onto wall **12**.

Wall **12** is preferably provided with a plurality of outwardly protruding extensions **18**. Although, extensions **18** may extend from top rim **14** of wall **12** or at substantially any position between top rim **14** and a bottom rim **13,** extensions **18** are preferably disposed in close proximity to bottom rim **13**. Extensions **18** protrude outwardly a sufficient length to enable contact with brew basket **50** (see Fig. 4). It is preferable that extensions **18** are flexibly attached to wall **12** so that extensions **18** may move relative to wall **12**. By flexibly connecting extensions **18** to wall **12**, exentions **18** may pivot relative to wall **12** until to top of device **10** sits below the top rim **51** of beverage brewing basket **50**, while remaining above the brewing ingredients. The flexing area of extensions **18** are preferably designed to allow for maximum flexing with minimum force, without fracturing. Extensions **18** may be

initially set perpendicular or at an angle relative to wall **12**. Extensions **18** are preferably formed of the same or similar material as wall **12**. Furthermore, extensions **18** are preferably integrally formed with wall **12**.

Supports **16** may be attached to wall **12** and project inwardly so as to reinforce filter medium **20**. A set of supports **16** may be positioned both on top and below filter medium **20**. Supports **16** may also be configured as inwardly projecting fins (see Fig. 3), which extend in parallel with wall **12**, as well as project inwardly therefrom. If supports **16** are configured as fins, supports **16** may be adapted for a user to grip device **10** therewith. Like extensions **18**, it is preferable that supports **16** be formed of the same or similar material as wall **12**. It is also preferable that supports **16** are integrally formed with wall **12**.

Device **10** may include a pair of opposing inwardly projecting ridges **17a** and **17b** (see Fig. 3) disposed in close proximity to the top rim **14**. Ridges **17a, 17b** are intended to releasably engage a pair of grooves **72a**, **72b** located at flared opposite ends of an elongated handle **70**. To facilitate the attachment of handle **70** to wall **12**, the opposing inwardly projecting ridges **17a, 17b** may be positioned at a remote end of a pair of opposing resilient cantilevered latching members **78a, 78b**. Cantilevered latching members **78a, 78b** may be made slightly shorter than top rim **14** so as to provide notched regions for receiving flared handle ends **74a, 74b** and for permitting handle **70** to sit substantially flush with top rim **14**, thusly providing a compact assembly. Alternatively, handle **70** may be integrally attached to wall **12**.

Filter medium **20** may be of any type including separating mediums and adsorbing mediums. For example, metallic mesh screens, spun-bonded or melt-blown polymeric non-woven materials, glass fibers, porous membranes, and paper may be used as separating mediums. Adsorbing mediums include iodinated resin, activated carbon, activated alumina, alumina-silicates, ion-exchange resins, manganese or iron oxides, and other materials having well-defined pore structures due to a high degree of crystallinity, such as zeolites. Filter medium **20** should provide suitably high flow and minimal pressure drop because the reserve capacity may be limited due to practical height constraints placed on the brewed beverage maker, particularly if designed for domestic use.

As shown is FIG. 5, filter medium **20** is most preferably a composite structure formed by an adsorbent supporting web substrate **70** having a surface **72** fused to a mixture of adsorbent particles **74** and binder particles **76**. Adsorbent particles **74** are coalesced or fused together by binder particles **76**, which are interposed therebetween. Also, some of the binder particles are fused to surface **72.** The composite structure is preferably obtained according to the method described in U.S. Patent No. 5,792,513, issued on August 11, 1998, which is incorporated in its entirety herein by reference. As described therein, a mixture of adsorbent particles **74** and binder particles **76** is applied to part or all of surface **72**, thereby producing a loose powder coating on surface **72**. The loose powder coating is heated to at least the Vicat softening temperature of binder particles **76**, but below the melting temperature of adsorbent supporting substrate **70** and adsorbent particles **74**. Pressure is applied to web substrate **70** to cause the softened binder particles to coalesce, or fuse together, adsorbent particles **74**, as well as adhere adsorbent

particles **74** to adsorbent supporting web substrate **70.**

Filtration medium **20** comprises an adsorbent supporting web substrate **70** that may be formed preferably using non-woven fibrous materials, such as the spun-bonded polyesters and polyolefins. Woven substrates may also be used. Furthermore, adsorbent supporting web substrate **70** may optionally be formed using cellulosic materials, such as paper, or a combination of cellulosic and thermoplastic fibers.

Materials forming binder particles **76** typically include thermoplastics such polypropylene, linear low-density polyethylene, low density polyethylene and ethylene-vinyl acetate copolymer.

Referring to FIG. 6, filter medium **20** can be modified to include an overlying web substrate **78**, which could be formed of materials similar to supporting web substrate **70**. Overlying web substrate **78** has a surface **80** facing coated surface **72** of adsorbent supporting web substrate **70**. Adsorbent particles **74** may also be adhered to surface **80** of overlying web substrate **78** by binder particles **76**. The fusing of adsorbent particles **74**, supporting substrate **70,** and overlying web substrate **78** can be accomplished according to the disclosure in U.S. Patent No. 5,792,513. Essentially, after applying the mixture of adsorbent and binder particles to the surface of adsorbent supporting web substrate **70** to produce a powder coating covering at least a portion thereof, as described above, overlying web substrate **78** is applied over both adsorbent supporting web substrate **70** and the powder coating thereon. Heat and pressure is applied to adsorbent supporting web

substrate **70** and overlying web substrate **78** to soften binder particles **76**. The softened binder particles coalesce, or fuse together, adsorbent particles **74**, as well as adhere adsorbent particles **74** to web substrates **70, 78**.

Both the adsorbent supporting web substrate **70** and the overlying web substrate **78** may provide supplemental particulate filtration. For example, filter medium **52** can reduce certain waterborne oocysts when web substrate **70** and overlying web substrate **78** are composed of a fine hydrophilic particulate filter medium, potentially combined with adsorbents such as activated carbon and heavy metal adsorbing zeolites. Co-pending U.S. Patent Application Serial No. 09/140,924, filed August 27, 1998, and assigned to the assignee hereof describes a low flow resistance composite filter medium for capturing at least 99.95 percent of particulates of a size in the 3 to 4 micron range, such as oocysts, and dissolved chemical contaminants from a fluid that can be used as a high flow rate filter medium in the present invention. The subject matter of that application is incorporated herein by reference in its entirety.

In use, as illustrated in FIG. 4, a liquid permeable holder for brewing ingredients, such as paper coffee grounds filter **53,** is placed within brew basket **50** and brewing ingredients are placed thereupon. Optionally, brewing ingredients can simply be placed within brew basket **50**. Device **10** is then fitted within brew basket **50**. Extensions **18** engage brew basket **50**. Thereby, brew basket **50** supports device **10** between top rim **51** and brewing ingredients **55**. In addition, brew basket **50** may be provided with indentations **57a, 57b** to better facilitate the fitting of device **10**. Liquid is then passed through device **10**. Contaminants in the liquid are

removed, killed, or rendered inert by device **10** before the liquid mixes with brewing ingredients **55**.

During use, device **10** is in direct contact with the liquid being passed therethrough. When hot liquid (about 185° F) is used, the material forming device **10** is heated, which reduces the stresses incurred at the hinge areas of extensions **18**. Reducing the stress at the hinge areas results in extensions **18** taking on a permanent set for future use.

There are two primary benefits of fitting device **10** distal to top rim **51** and separated from brewing ingredients **55**. First, device **10** may be retrofitted into virtually any beverage brewer. Second, device **10** will not become contaminated with wet brewing ingredients.

The present invention having been thus described with particular reference to the preferred form thereof, it will be obvious that various changes and modifications may be made therein without departing from the spirit and scope of the invention as defined in the appended claims.